CLAIMS

We Claim:

1. A method for designing a network in which nodes originate and terminate traffic to keep delay related to node-to-node delay-sensitive communication below a specified threshold, the method comprising:

obtaining an initial network topology including links and traffic routing based on a volume of traffic;

allocating a maximum delay to each link in the network topology in proportion to the square root of an imputed cost for each link;

sizing a bandwidth required for each link based on a current traffic routing and at least one of a maximum delay allocated to the link;

determining link lengths; and

rerouting traffic according to shortest paths with respect to the determined link lengths.

2. The method of claim 1, wherein sizing the bandwidth requirement is further based on a total link utilization.

3. The method of claim 1, wherein allocating a maximum delay to each link further provides that so that established delay limits on node-to-node communication are satisfied.

4. The method of claim 1, further comprising repeating all of the steps until the network design ceases to change.

5. The method of claim 1, wherein the delay allocation, link length and routing are determined separately for each of a plurality of traffic classes, and wherein link bandwidths are sufficiently sized for all of the plurality of traffic classes.

6. The method of claim 1, further comprising the additional step of systematically examining the network topology to determine if at least one of eliminating or adding any given link would reduce a cost of the network.

7. The method of claim 5, further comprising the additional step of systematically examining the network topology to determine if at least one of eliminating or adding any given link would reduce the cost of the network.

8. The method of claim 5, wherein the sizing step further comprises determining the sizing of the bandwidth by assigning virtual channels to each of the plurality of traffic classes, with the bandwidth of each virtual channel being sized separately and wherein a total bandwidth on the link is based on the sum of the bandwidths of the virtual channels as well as on a maximum utilization factor for the links.

9. The method of claim 1, wherein the determining step further comprises determining the link lengths based on the marginal cost of the link with respect to the

total traffic that is routed on it by taking the product of a marginal cost of the bandwidth with respect to current link bandwidth required and a marginal link bandwidth required with respect to traffic routed on the link.

10. The method of claim 5, wherein the determining step further comprises determining the link lengths based on the marginal cost of the link with respect to the total traffic that is routed on it by taking the product of a marginal cost of the bandwidth with respect to current link bandwidth required and a marginal link bandwidth required with respect to traffic routed on the link.

11. The method of claim 10, wherein the determined step uses the same set of link lengths for every class of traffic based on a weighted sum of the link lengths determined separately for each traffic class.

12. An apparatus for designing a network comprising:

a database; and

a module connected with the database that:

obtains an initial network topology including links and traffic routing based on a volume of traffic;

allocates a maximum delay to each link in the network topology in proportion to the square root of an imputed cost for each link;

sizes a bandwidth required for each link based on a current traffic routing and at least one of a maximum delay allocated to the link;

determines link lengths; and

reroutes traffic according to shortest paths with respect to the link lengths.

13. The apparatus of claim 12, wherein the module sizes the bandwidth requirement further based on a total link utilization.

14. The apparatus of claim 12, wherein the module further allocates the maximum delay to each link so that established delay limits on node-to-node communication are satisfied.

15. The apparatus of claim 12, wherein the delay allocation, link length and routing are determined separately for each of a plurality of traffic classes, and wherein link bandwidths are sufficiently sized for all of the plurality of traffic classes.

16. The apparatus of claim 12, wherein the module further determines the sizing of the bandwidth by assigning virtual channels to each of a plurality of traffic classes, with a bandwidth of each virtual channel being sized separately and wherein a total bandwidth on the link is based on the sum of the bandwidths of the virtual channels as well as on a maximum utilization factor for the links.

17. The apparatus of claim 12, wherein the module further determines the link lengths based on the marginal cost of the link with respect to the total traffic that is routed on it by taking the product of a marginal cost of the bandwidth with respect to current

link bandwidth required and a marginal link bandwidth required with respect to traffic routed on the link.

18. The apparatus of claim 15, wherein the module further determines the link lengths based on the marginal cost of the link with respect to the total traffic that is routed on it by taking the product of a marginal cost of the bandwidth with respect to current link bandwidth required and a marginal link bandwidth required with respect to traffic routed on the link.

19. The apparatus of claim 18, wherein the module further determines the same set of link lengths for every class of traffic based on a weighted sum of the link lengths determined separately for each traffic class.